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# **Children and Adolescents with Primary Tension-Type Headaches: Research and Practice Perspectives for Non-Pharmacological Interdisciplinary Headache Service**

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Birte Tornøe

Additional information is available at the end of the chapter

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## **Abstract**

**Background:** Children and adolescents with frequent and chronic primary headaches are, with a prevalence of 2–23% depending on diagnosis, age, sex and frequency, a global health concern. Research on non-pharmacological treatment outcomes is sparse. Headache service faces a challenge because possible sensitisation of pain pathways can affect outcomes leading to a delay in becoming symptom free or being cured.

**Method:** This chapter provides a narrative review of research containing suggestions for relevant focus areas for professionals who work with children and their parents in the process of self-care.

**Conclusions:** Research supports that increased pericranial tenderness in children with consistent primary tension-type headache is a consequence of activated pain pathways and relevant for clinical assessment. Tension patterns, posture, muscle balance and strength in the neck/shoulder region are areas of importance for minimising the triggering of input to the nociceptive system. Lifestyle factors such as sleep, nutrition, stress and tension regulation, posture and ergonomics, physical activity (PA) and exercise are a key part of non-pharmacological team service. Empowering patient education that provides children and adolescents with the knowledge and drive to persistently pursue healthy lifestyle changes is the basis for potentially successful outcomes in terms of ethical, cultural and educational issues.

**Keywords:** children, headache service, empowering patient education, stress and tension regulation, aerobic power

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## 1. Introduction

Children and adolescents with frequent and chronic primary headaches are, with a prevalence of 2–23% depending on diagnosis, age, sex and frequency, a global health concern [1–4]. The age span is 3–18 years depending on the disorder. The main consequences of frequent headaches in children and adolescents are more frequent school absences; disturbed health-related quality of life (HRQOL) [5] and a risk of medication overuse [6].

An interdisciplinary specialist team is a relevant health care platform for the professional support to the families in the process of self-care and recovery. A specialist team is suggested to consist of neuro-paediatricians, nurses, physiotherapists, psychologist and possibly a social worker [7].

The diagnosis of the child's headache as a neurological disorder is the first important step in an interdisciplinary team service and is carried out based on the International Classification of Headache Disorders (ICHD-3-beta) [8]. The most frequent diagnoses for children are migraine with or without aura, tension-type headache (TTH) or a combination of both, such as mixed headaches. Girls present the highest prevalence for TTH [4], but there is conflicting evidence as to whether boys or girls predominantly have mixed headache [1, 9].

There is a consensus that the aetiology and relevant factors are multi-dimensional with dynamic interaction between genetic, hormonal, neural and muscular mechanisms but also psycho-social and environmental factors. Researchers agree that migraine and TTH are two different headache disorders [1], though some see it as a continuum [9]. They may, however, interact, which is why efforts concerning TTH might be beneficial for the child with both disorders. Frequent and chronic types of headache, which means they occur more than 10–15 days a month, present the greatest challenge.

Research on non-pharmacological treatment outcomes is sparse. Headache service faces a challenge because possible sensitisation of pain pathways can affect outcomes leading to a delay in becoming symptom free or being cured. It is therefore important to empower children, adolescents and their involved parents to persistently pursue healthy lifestyle strategies, which could lead to a long-lasting reduction of headache frequency and prevent disability.

A narrative review [10] approach is used in the following sections to describe and discuss relevant areas of interest supported by research that might lead to headache reduction in children suffering from primary TTH.

## 2. Research on hypersensitivity

Langemark and Olesen were the first to focus on pericranial tenderness in adults with TTH [11]. Forty individuals with TTH and 40 controls were palpated by a blinded observer for tenderness in 10 pericranial bilateral sites using a four-point scale called the Total Tenderness Score (TTS) (Table 1). Results indicated a significant difference in tenderness between the two

groups. Bendtsen et al. [12] examined later the use of a palpometer, which allowed measurement of palpation pressure during palpation. The palpometer was a small instrument with an arbitrary scale connected to a pressure-sensitive plastic device attached to the finger used for palpation. The use of the palpometer was recommended for research. Using the same observer between palpations was recommended to keep the amount of pressure stable. The TTS system was validated with the use of the palpometer [13].

0	No visible reaction and denial of tenderness
1	No visible reaction but verbal report of discomfort or mild pain
2	Verbal report of painful tenderness, facial expression of discomfort or no reaction
3	Marked grimacing or withdrawal, verbal report of marked painful tenderness and pain

**Table 1.** Langemark and Olesen’s four-point total tenderness score [11].

Further research by Bendtsen et al. [14] focused on pericranial tenderness measured by a palpometer and TTSs; and pressure pain thresholds and tolerance recorded by an electronic pressure algometer at the non-dominant second finger and at the temporalis muscle. Similar to earlier studies the results showed significantly increased pericranial tenderness of all-sites-pericranial myofascial tissue in adult patients with chronic TTH (CTTH) compared with healthy controls. The results showed a decrease in pressure pain thresholds and tolerance, but these results were considered debatable. Results also showed a shift to the left compared with healthy controls when examining the functions for pressure pain thresholds and tolerance versus pain on both sites. The results were interpreted as indicators of general hypersensitivity in patients with CTTH.

At the time, there were also parallel studies focusing on children with headaches. For example, Carlsson [15] examined 113 Swedish schoolchildren with frequent headaches compared with 109 headache-free controls. The children were examined by manual palpation of seven bilateral pericranial sites and TTS. Children with headache had significantly higher tenderness, and children with chronic headaches had significantly higher tenderness for all sites, except the frontalis muscles. The mean tenderness scores were significantly correlated with the frequency of chronic tension-type headache (CTTH).

Additional studies involving children were conducted. Tornoe et al. [16] examined pericranial tenderness in 41 girls 9–18 years of age with frequent episodic TTH (FETTH) and CTTH compared with 41 healthy controls by means of TTS. Results showed significantly higher tenderness scores for girls with headache in all sites. Results showed a significant positive correlation between headache frequency and tenderness.

Soee et al. examined 59 children 7–17 years of age with FETTH and CTTH compared with 57 healthy controls. Examinations were conducted by means of the TTS at seven pericranial myofascial sites and the use of the original palpometer. Children with headache had significantly increased tenderness in all sites. The sites with the highest level of tenderness in children with and without headache were the trapezius descendens and its occipital insertions. Further

examinations were conducted by means of algometry of pressure pain thresholds at three pericranial sites and suprapressure pain thresholds [17]. Sensitivity showed no significant increase measured by pressure pain and suprapressure pain thresholds compared with controls. Results from factor analyses indicated an association between pericranial tenderness and the child’s general level of pain processing.

Pericranial sites/studies	Adults			Children		
	Langemark and Olesen (1987)	Bendtsen et al. (1994–1996)	Jensen et al. (1992–1998)	Carlsson (1996)	Soee et al. (2013)	Tornoe et al. (2011–2016)
M. Frontalis	X	X	X	X	X	X
M. Pterygoideus Medialis	X					
M. Pterygoideus Lateralis	X		X			
Hamulus Pterygoideus			X			
M. Masseter	X	X	X	X	X	X
Processus Coronoideus Mandibulae	X	X	X			
M. Sternocleido-Mastoideus	X	X	X	X	X	X
M. Trapezius	X	X	X	X	X	X
M. Temporalis	X	X	X	X	X	X
Processus Mastoideus	X	X	X	X	X	X
Occipital Muscle Insertions	X	X	X	X	X	X
M. Orbicularis Oculi				X		X
M. Corrugator Supercilii				X		
M. Rectus Capitis Posterior Major			X			
M. Splenius			X			

**Table 2.** Bilateral pericranial sites originally used in research for total tenderness score in TTH.

In another study, Soee et al. [18] conducted algometry and pain scoring for five increasing pressure intensities at two pericranial sites, the trapezius descendens and temporalis, on the non-dominant side. Fifty-eight children with FETTH and CTTH and 57 healthy controls participated. The area under the curve for stimulus-response functions was analysed. Similar to the results for adults in Bendtsen’s [14] study, the stimulus-response functions for pressure versus pain showed a shift to the left, indicating hypersensitivity, especially for the group of children with CTTH. Soee et al. concluded that the temporalis site was the most sensitive and that quantitative and qualitative changes in pain perception occurred on a continuum, with

FETTH representing an intermediate state between healthy individuals and CTTH. In addition, Fernández-de-las-Peñas et al. [19] found bilateral pressure hypersensitivity in a study using the temporalis, trapezius descendens and tibialis anterior muscles in 25 children 5–11 years of age with FETTH compared with 50 healthy controls.

In a randomised controlled intervention trial with specific strength training versus interdisciplinary counselling [20], headache frequency and duration declined significantly over the space of 22 weeks, but pericranial tenderness did not change significantly in a positive direction. These results indicate that generally increased pericranial tenderness and hypersensitivity might predict a delay in becoming symptom free or being cured.

In summary, in both adults and children with TTH research support the findings of altered pain perceptions with hypersensitivity probably due to changes in both periphery and central pain pathways. A continuum between the healthy children and the children with chronic headaches is seen with the FETTHs as intermediates. The TTS as a palpation test seems an applicable and non-invasive examination for children in the clinic. To picture hypersensitivity tenderness in all pericranial sites would be expected. There is a need for revalidation of the TTS with the use of a calibrated palpometer in order to avoid large test-retest variations as found by Tornøe et al. [21] There is also a need for more research in order to establish a cut-off value between normal and pathological levels of tenderness in children. **Table 2** presents the bilateral pericranial sites originally used in research for TTS.

### 3. Tension patterns and self-regulation

Other names for TTH were tension headache and muscle contraction headache. Throughout the decades, various hypotheses and findings about the underlying mechanisms have served as a guide to developing a solid, evidence-based approach. In addition to research on pericranial myofascial tenderness and hypersensitivity, examining tension patterns in pericranial muscles and how to regulate tension and stress have also been of interest. Surface electromyographic biofeedback (SEMG) and progressive relaxation training have been examined with success in children suffering from TTH, though large-scale randomised controlled trials are still needed.

Focusing on the frontalis muscles, Grazzi et al. [22] examined SEMG biofeedback in 10 children 12–15 years of age with TTH. The children participated twice a week for 12 sessions and were also encouraged to use daily relaxation techniques at home. The results indicated a significant decrease in EMG activity and headache intensity from the first to the last session. Bussone et al. [23] did a subsequent larger controlled study with follow-up to 12 months. Their results showed a significant reduction in headache parameters but not in tension levels. The site was frontalis, and the feedback was auditory. In a 3-year follow-up study [24], results likewise showed long-lasting improvements after EMG biofeedback relaxation training for children with TTH, with further gains over the course of 3 years. Other researchers have examined biofeedback and relaxation therapy in various forms and find SEMG frontalis biofeedback to be superior. Results showed a long-lasting, continuously increasing effect [25]. The continuous



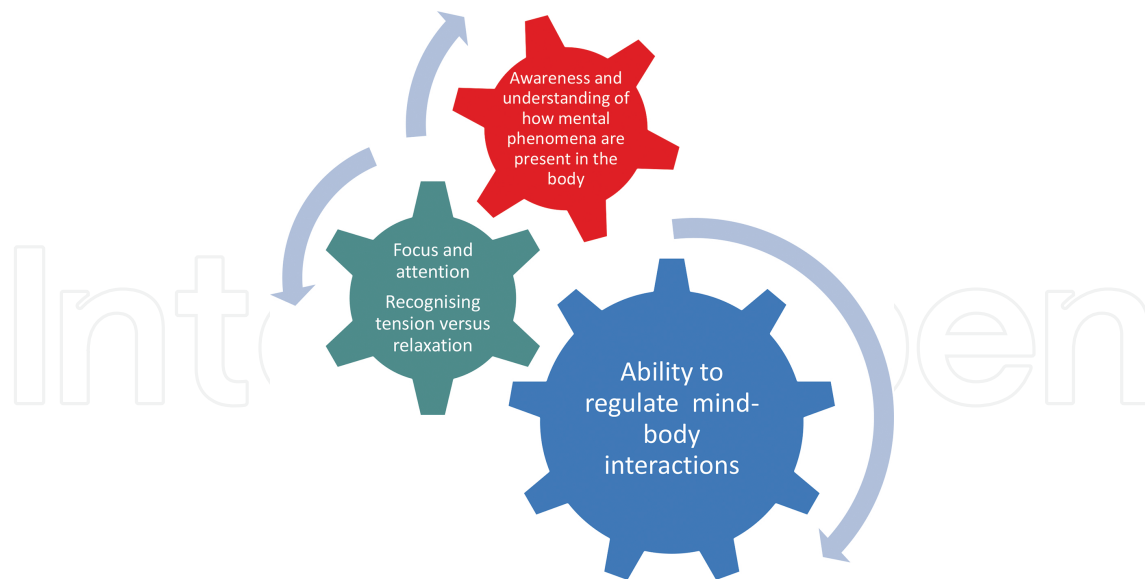
effect indicates that children learn how to use and integrate the relaxation techniques into their daily lives.

Hermann and Blanchard [26] reviewed studies evaluating interventions with biofeedback and relaxation for children and reached an overall positive conclusion. They discussed how to distinguish between the input from biofeedback and the use of relaxation techniques, a distinction Kröner-Herwig et al. also make [25]. The question of whether the positive outcomes relate to an alteration in mental stress, muscular activity or a combination of the two was discussed and is still relevant.

Evidence on repetitive recruitment of motor units followed by pain, possibly altered muscle activation patterns and muscular cellular dysfunctions in adults with computer work-related trapezius myalgia has also propelled headache research. Even though the trapezius descendens (the upper trapezius) has been shown to be the most tender myofascial pericranial site in children with TTH, little research has been done on SEMG biofeedback from the trapezius muscle. One study compared frontalis SEMG biofeedback with trapezius SEMG biofeedback and progressive relaxation therapy alone in adults [27]. The results suggested that trapezius SEMG biofeedback training might be more efficacious for CTTH with a significant effect above 50%.

Children under the age of 13, who have not yet fully developed the ability to reason abstractly, need age-appropriate learning situations. Tornøe et al. [28] evaluated a study involving computer-animated SEMG biofeedback by placing sensors on the trapezius descendens and by employing an age-appropriate form of progressive relaxation techniques. The children, 7–13 years of age, worked with visual and auditory computer-animated feedback from screens showing brief videos. Additionally, a bar graph gave the child a visible response each time a certain tension threshold was exceeded. The sensor placement on the trapezius muscles provided the children a feedback from posture, breathing, tension and heart rate. Furthermore, SEMG data were also recorded. Comparing the pre-and post-treatment means of root mean squares and median frequencies showed a minor non-significant reduction for nine children across a nine-session programme. The SEMG results showed a significant within-session ability to up and down regulate tension. The study results showed a statistically significant reduction in headache frequency.

Oral and written evaluations by the children indicate that they felt they were able to moderate feelings of stress, multiple thoughts and emotions experienced as negative or stressing. The children likewise managed to regulate the way these mental phenomena presented in the body as increased heart rates, hyperventilation and/or muscle tension. Achieving a sufficient level of self-regulation experience and expertise appeared to require 9–10 sessions. Recent studies examined the additional use of internet-based self-help programmes and supported the applicability of the internet for cognitive-behavioural interventions [29], although evidence on headache reduction is conflicting [30]. **Figure 1** presents learning aspects of self-regulation.



**Figure 1.** Using progressive relaxation techniques to learn self-regulation. This image belongs to the author of the chapter: PhD Birte Tornøe.

#### 4. Lifestyle-related physical factors and resources

The neck/shoulder muscles are involved in the underlying pathology of headache. One hypothesis on adult patients with CTTH confirmed in findings was that higher tension levels measured by EMG in the trapezius muscles increase input from myofascial tissue leading to hypersensitivity [31]. Evidence of increased tension levels, however, shows conflicting results in adults, and EMG studies in children are sparse. A summary by Bendtsen and Fernandez-de-las-Penas [32] points out that prolonged nociceptive stimuli from myofascial input could be a result of continuous activation of local structures followed by microtrauma of selected muscle fibre, thus leading to increased hypersensitivity. They consequently recommended that specific attention be paid to the muscular factors underlying TTH [32]. From this perspective, the involvement of the trapezius muscles in computer-related workplace research is interesting. In a study involving adult females with trapezius myalgia, results from muscle biopsies indicated that women with trapezius myalgia had a higher percentage of hypertrophied type-I fibres with poor capillarisation. The findings were associated with long-term working exposure [33]. Recent studies on surface and intramuscular EMG support the involvement of subparts of the trapezius muscles related to both attention tasks and anticipatory motor programming of precise finger typing and manipulation. The latter could be approached with the use of elbow support, which would decrease the need for anticipatory shoulder stabilisation. Maintaining work-related local activity is believed to impair cellular mechanisms, leading to increased input to free nociceptive nerve endings [34]. In conclusion, both headache research and research in physiology and ergonomics support evidence on the involvement and impairment of subparts of the trapezius muscles in continuous daily, and especially work-related activities, leading to prolonged nociceptive input and hypersensitivity.



#### 4.1. Posture, muscle activity and the use of electronic devices by children

Children and adolescents worldwide use iPads, computers and mobile phones for schoolwork and leisure activities. Children with TTH have been associated with more frequent use of computers than healthy controls [35]. Straker et al. [36] examined posture and muscle activity in young children with a mean age 5.6 years who were using either a tablet, desktop or paper. SEMG and 3-D-motion data were used to collect data. Desktop computers were associated with a more upright position and less muscle activity than both tablets and paper. On the other hand, desktop computers were associated with a more constrained and monotonous posture, while tablet and paper allowed for greater variation. The use of a tablet was associated with a more flexed posture, elevated shoulders and more muscular activity in the trapezius descendens muscles and cervical erector spinae. A study of children 10–12 years of age also indicated the same implications for computer use by children as are reported for adults. The mid position of the screen was shown to be the preferred position in terms of gaze, posture and muscle activity in the trapezius descendens and cervical erector spinae [37]. As a result, ergonomic advice and adjustments in the working environment for children with and without headache is recommended, particularly with the widespread use of tablets in schools and the amount of time spent using electronic devices. Straker et al. [38] reviewed the physical aspects of children's interaction with computers. The aim was to set up guidelines on how to use them wisely as a result of concerns about how extensive use of electronic devices might pose a risk to their development and health. A long list of recommendations emerged stressing that parents, teachers and health professionals have a responsibility to act and also to teach children how to use them prudently. Workplace adjustments, computer skills, body awareness (especially of bodily signals due to overload), transporting equipment, and physical exercise and activity are important to counter adverse consequences.

#### 4.2. Muscle strength, aerobic power and health

In a historical review of research on physiology and ergonomics, Sjøgaard [39] shows that research indicates that physical exercise and activity can counteract the negative effects of muscular overload, producing a health-enhancing effect. Strength training in particular three times weekly for 10 weeks has a positive effect on muscular recovery. A study comprising girls 9–18 years of age with FETTH and CTTH found a significant association between headache and reduced neck/shoulder muscle strength and aerobic power [16]. Specific strength training of the trapezius descendens in particular was hypothesised to lead to significant headache reduction, which was confirmed in a later study [20]. At baseline the girls reported a perceived deficit in physical, emotional and school functioning domains and health measured by HRQOL questionnaires. Exercising and interdisciplinary counselling showed long-term improvements in these areas. Results indicated that the girls, who were interactive in exercising, gained greater physical results measured by strength and aerobic power than the girls who were verbally counselled to be more physically active.

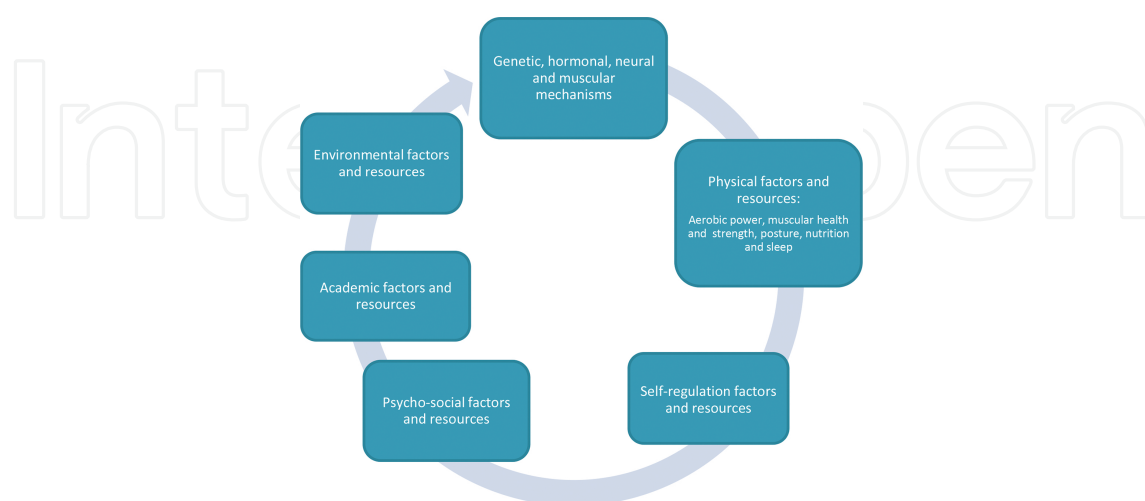
The awareness of the importance of aerobic power in relation to headache is relatively new. The Norwegian HUNT3 study [40] also showed a significant inverse relationship between any type of headache and measured peak oxygen uptake in a sample of 3899 adults 20–50 years of

age. Physical activity (PA) showed a similar relationship. It currently remains unclear as to what is cause and what is effect, but the truth is that perhaps they are both. Generally, muscular fitness, aerobic power (cardiorespiratory/cardiovascular fitness) and speed/agility are considered important markers for health in childhood [41], making this an important focus area for future research and interventions for children and adolescents with headache.

### 4.3. Sleep, nutrition and stress

Interdisciplinary counselling along with physical education for children and adolescents with TTH has a significant effect [20]. A recent study of 509 children 9–15 years of age with frequent weekly headaches [42] found that dysfunctional coping strategies for stress are negatively associated with the probability of headache remission. Other psychological variables were not significant. Girls presented higher prevalence and lower probability of remission than boys. Children, and especially girls, appear to need empowered learning on how to manage self-care in daily life by using active coping strategies. The perceived areas of deficit, such as physical, emotional and school functions, are of interest. Impaired school functioning is the least recognised area and needs further research. Examining and counselling on how to cope with and reduce stress and optimising sleep quality and nutrition are important areas to explore. An association has been confirmed between sleep difficulties and children with headache, which is why the underlying causes should also be addressed [43].

Enhancing PA is one way to regulate stress and to achieve better quality of sleep. The effect of PA on stress, anxiety, sleep quality and mental wellbeing may even be superior to mindfulness meditation and heart rate variability biofeedback [44, 45]. A certain amount of PA is necessary to maintain and improve aerobic power and health. Families should be empowered to follow the guidelines and recommendations set by the World Health Organization (WHO) [46]. **Figure 2** presents the possible interacting mechanisms underlying paediatric headache.



**Figure 2.** Possible interacting mechanisms underlying paediatric headache. This image belongs to the author of the chapter: PhD Birte Tørnøe.

## 5. Empowering patient education

### 5.1. Empowerment

Over the years, health research has examined how to encourage the management of self-care in patients. Headache and other paediatric services face the challenge of how to empower the knowledge and understanding the children and parents have of specific focus areas and how to engage the child and parents in the process of changing health behaviour and incorporating active coping strategies.

The concept of empowerment developed in policy and social research in the 1960s and 1970s. From a medical perspective, Foucault stressed the need for patient knowledge, dialogue and shared decision-making [47]. Later, nursing research explored empowerment, with Leino-Kilpi defining the various dimensions of empowering patient education in a model to be used as a tool for examining and evaluating patient education [48]. The knowledge and skills acquired were the outcomes measured. Knowledge and knowledge expectations are key topics. A large European survey of adult surgical orthopaedic patients undergoing patient education concluded that knowledge and knowledge expectations differ between cultures and people depending on their background. The highest expectations were with regard to the physiological and functional knowledge dimensions [49].

Aujoulat et al. [50] discussed the lack of conclusive definitions of empowerment but revealed a number of guiding principles. Empowerment is seen as both a process and an outcome [51, 52]. The empowerment process can be divided into two parts: (1) an intra-personal dimension where the individual transforms due to interactive learning and (2) an inter-personal dimension arising from the relationship between the patient and health provider [50, 51]. A key point is that an educational partnership is required to support and empower the patient (1) to collaborate, engage and be able to manage decision-making; (2) to gain knowledge and skills to cope with psycho-social and functional issues; (3) to have the right to self-determination; (4) to mobilise resources to become responsible and efficient in self-management; and (5) to adhere to mutual plans [48, 50, 53]. Time and experience are stressed as important factors in empowerment. Participation and interactive learning are key topics [50, 51].

Child participation and decision-making are a specialist area as children are vulnerable participants in health care service. Decision-making involving children is linked to the ethical and legal rights of the child [54]. Children move through various stages of knowledge and cognitive skills, and have the right to participate regardless of the demands their developmental stage puts on how parents and professionals act. Generally, children develop their decision-making skills as they get older, with 18 the legal age of consent for treatment. Until then, professionals and parents act as proxies on behalf of the child and work in the child's best interest throughout childhood [55], even though children may not know their rights or may not want to participate. As a result, involved parents and professionals should encourage the child to participate and be interactive in learning and decision-making, but they should also respect the child's wishes and opinions [55]. Research points out that shared participation, decision-making and shared learning experiences with parents promote positive outcomes

[56], but in order to avoid an asymmetrical relationship, focusing on child-centred care, where the child is a key, active agent [57] guided by adults, is recommended.

As an advocate for adolescent-friendly health services, the WHO established quality standards in 2012 for this area [58], emphasising that services should be available, affordable and in an attractive environment. Ideally, adolescents should be involved in designing the service, which should provide up-to-date appropriate information and education that enables children and adolescents to make informed choices. Adolescents should be involved in monitoring and evaluating experiences. Interventions should be evidence-based, and the health service should encompass knowledge about general health needs. In addition, the health care staff should possess the necessary skills and be given sufficient time to provide care. Finally, all procedures should guarantee client confidentiality and value cultural and religious needs. In 2015, the European Health Parliament established a similar framework on patient empowerment and patient centredness [59].

## **5.2. How to facilitate health behaviour change**

Various actors must be taken into consideration for health services, including the child, parents, professionals and the organisation, each of which perhaps has its own gender-specific culture and motivation. Research results show that additional fields of action must be examined in order to address these complex areas.

### *5.2.1. Child, parents and network*

Engaging in PA decreases with age, though less so for boys than for girls [45, 60], indicating that this area needs more attention. In order to guide children to further pursue a physically active lifestyle, greater insight is needed into what key factors play a role. The Canadian Assessment of Physical Literacy (CAPL) [60] is an instrument validated in healthy children that offers assessment of PA, physical competence, motivation and confidence, knowledge and understanding related to a physically active lifestyle for children 8–12 years of age [60] and can provide insight into empowering elements. Further research will show whether CAPL can be used to benefit children with headache by pushing efforts in the right direction.

Little is known, in fact, about what motivates children. Trollvik et al. [61] examined what children experienced in a meaningful learning programme for children with asthma. The learning approach was varied and included storytelling, conversations, dialogue (including about bodily experiences) and interactive group activities. Qualitative evaluations based on recordings and observations showed that the following had a positive impact: (1) a warm and positive climate, (2) the opportunity to express and share feelings and reflections, (3) gaining new knowledge about the disorder and themselves and (4) interacting with other children and health care professionals. The study included a variety of communication methods to give the children both mental and bodily experiences.

Research indicates that parental participation plays an important role when children need empowering physical education [62]. Respecting the child/adolescent's needs, nurses and physical therapists can encourage and support families to make time to be physically active

together, or to support the child, especially daughters, in other ways to promote a healthy lifestyle. Fathers and mothers influence their children differently, which is why health care staff should consider working with gender-specific approaches [63]. Parental support can be divided into actions that are instrumental, conditional, motivational and informational [63]. For example, parents can motivate their children and adolescents and give them information; and they can pay any expenses, for equipment and for transportation (instrumental). Direct parental involvement in PA (conditional), where the fathers' active involvement appears to be very important, is associated with increased levels of PA [45, 63]. Parental support has also been shown to result in the enhanced psycho-social wellbeing of the child [63]. Social support, including knowledge, beliefs and attitudes, from peers/friends and family also seem to have a clear positive effect on the PA level of adolescents [45, 63]. A positive climate, enjoyment and social elements are also known to facilitate the participation of children and adolescents [45], while a lack of time is perceived as a barrier [20, 45].

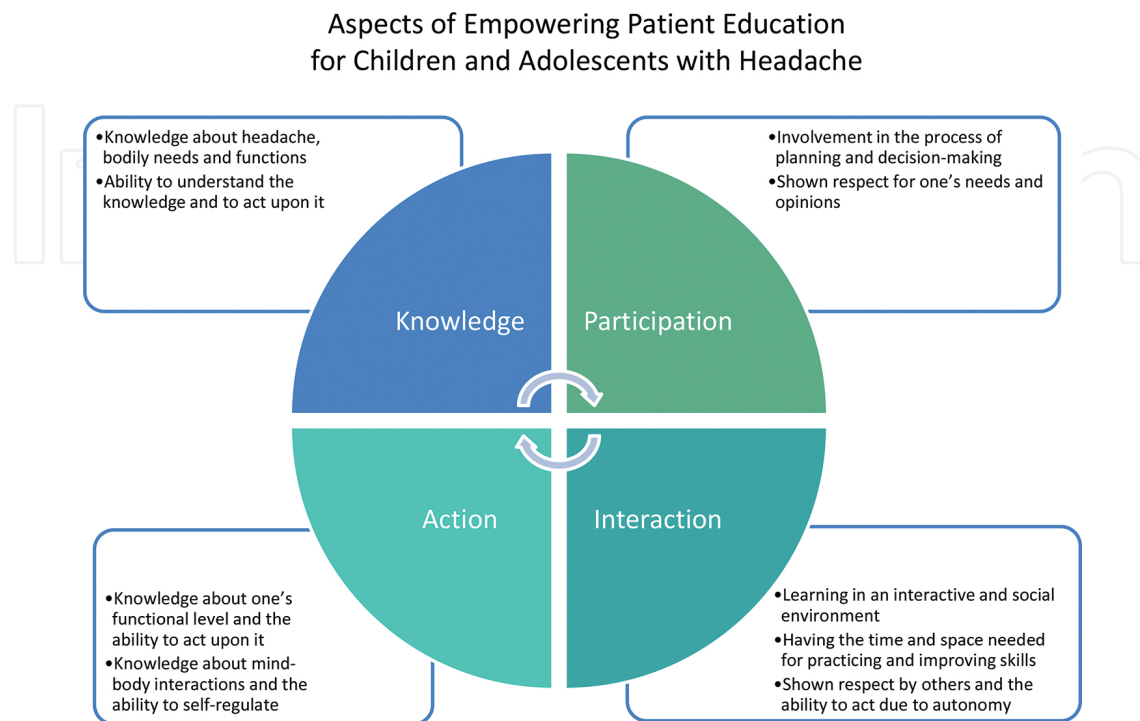
### *5.2.2. Professionals in the organisation*

It is important to gain insight into the role, behaviour and thoughts of professional staff working in paediatric health care departments. Elwell et al. [64] conducted 33 interviews with clinical staff in inpatient and outpatient hospital services in order to identify the barriers and facilitators they experienced when providing advice to children and their families about healthy lifestyle behaviours. Barriers included a lack of time, a lack of feedback about whether the advice had had a positive impact and the constraints of working in a hospital environment. The facilitators included seeing health promotion as an important educational activity (not just information) that leads to cost savings, decreased admissions and better child health. In order to implement an educational activity that leads to positive outcomes, it is maintained that health care professionals must be trained. This argument is supported by Kelo et al. [56], who also examined how nurses perceive the utilisation of empowering education in school-aged children with diabetes and their parents. The study identified four phases or categories for successfully managing this process: assessment of knowledge, skills and needs, planning, implementation, including participation and interactivity, and finally evaluation and feedback for the family. It was stressed that educating children must be based on developmental psychology because of the various psychological and functional abilities that characterise the different ages [56, 65]. The study describes the complexity of an empowering patient education in detail, as well as the variety of approaches used. Nurses experienced management and leadership challenges due to a lack of expertise, a lack of resources and uncertainty. Also the situation of the child and parents, with their various attitudes and behaviours, was contained. The nurses experienced that, despite the challenges, empowering patient education made sense and contributed a positive learning effect for the participating children and their parents, which is an outcome that should be studied further.

The multiple components in this study clearly show that empowering patient education is a complex intervention that requires the organisation and professionals to adapt their work practices to accommodate the complexity [53, 56]. Homogenisation and standardisation in hospital organisations, however, may work to thwart the aim of empowering education and



child centredness. **Figure 3** presents aspects of empowering patient education for children and adolescents with headache.



**Figure 3.** Aspects of empowering patient education for children and adolescents with headache. This image belongs to the author of the chapter: PhD Birte Tornøe.

## 6. Implications for headache service for children and adolescents

Empowering patient education has long-lasting positive outcomes for paediatric health care services. It implies giving the child, adolescent and involved parents a platform for experiential and interactive learning, where the child's right to autonomy and self-determination is respected and the child's motivation considered. Setting aside a sufficient amount of time is necessary for the various phases of a high-quality empowering educational programme, which include: examination, planning, education, implementation and, finally, evaluation and feedback. This involves managing a variety of communication and interactive methods. A child/adolescent-friendly atmosphere with pleasant social activities is empowering. These features combined mean that the staff who lead and manage the educational programmes must be prepared and have the necessary training. The organisation should also be able to encompass the complexity of the programme in order to live up to WHO and EU Health Parliament standards.

The educational content for children and adolescents with primary TTH is linked to general and specific health knowledge and skills. The strategies needed work to reduce psychophysiological overload. Muscle load is seen leading to prolonged nociceptive input to pain



pathways with subsequent hypersensitivity and chronic pain. Sufficient amounts of aerobic power achieved through training and outdoor play enhance health, and can also be used as active stress-coping strategies. Stress, sleep and nutrition hygiene also work to help accumulate the resources needed to cope with the demands of daily life and to reduce a psycho-physiological load.

Specific strength training, especially of the upper trapezius, might reverse negative muscular consequences from repetitive work with electronic devices. It is also necessary to reach a sufficient volume of training.

Relaxation training with SEMG and visual and auditory feedback is another interactive, effective learning process for children, which also tends to reduce prolonged nociceptive input. Awareness of and training on how to modulate workloads, posture, breathing and heart rate provides the knowledge and skills to self-regulate mind-body interactions in daily life.

## 7. Short conclusions

- Girls have a higher prevalence of TTH and a lower probability of headache remission, which is why children and adolescents may benefit from a headache service that focuses on the possibly different knowledge and needs of girls and boys.
- TTS is an applicable, non-invasive examination for children in the daily headache clinic. The palpation test can be used for examining pericranial tenderness as a consequence of pain hypersensitivity. Further research is needed to revalidate TTS with the use of a calibrated palpometer and to examine levels of sensitivity and specificity with cut-off values.
- Neck/shoulder muscles are involved in the underlying pathology of headache in children and adults. Muscle load from repetitive work can result in dysfunctions in muscular cellular mechanisms, thus leading to prolonged nociceptive input. Specific strength training, an adequate level of physical fitness and ergonomic learning can help restore the negative impact of repetitive work.
- Implementing relaxation techniques in paediatric educational programmes can also be beneficial. Courses must comprise at least ten sessions to provide the child and adolescent with enough time to experience how to work with and benefit from self-regulation techniques and stress-coping strategies, optionally combined with internet-based programmes. Computer-animated EMG biofeedback provides children with quick, easy and understandable visual and auditory feedback on the regulation of tension.
- Aerobic power is an important overall health marker for children and adolescents and is also a way to regulate stress. Parental participation and supportive behaviour play an important role in enhancing the PA of children, especially girls. A high level of PA also helps balance the time spent on electronic devices, which in turn has a positive impact on the child's health and development.

- Time and space to interact, practice and improve skills promotes successful outcomes for children and adolescents with headache. Shaping a social environment that involves interaction with friends and family is important to empower the child and adolescent to learn. A perceived lack of time, on the other hand, is a barrier in the daily life of families. More research is needed on how to approach this dilemma.
- The underlying mechanisms of headache are multi-systemic and involve various mental and physiological functions that need to be dealt with. Research indicates that the time span leading to successful outcomes lies between 3 months and 3 years. Setting aside time to develop and conduct high-quality, complex empowering educational programmes appears to raise the level of satisfaction and outcomes in children, adolescents, their involved parents and headache professionals.

## Author details

Birte Tornøe

Address all correspondence to: [birte.tornoe@gmail.com](mailto:birte.tornoe@gmail.com)

1 Residence: Copenhagen, Denmark

2 Department of Health Sciences, Faculty of Medicine, Lund University, Sweden

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